

US EPA ARCHIVE DOCUMENT

ASSESSMENT OF DAM SAFETY OF COAL COMBUSTION SURFACE IMPOUNDMENTS



**Crisp County Power
Commission
Plant Crisp
Warwick, Georgia**

Prepared for
*U.S. Environmental
Protection Agency
Washington, D.C.*

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CDM Smith Project
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Section 1

Introduction, Summary Conclusions and Recommendations

1.1 Introduction

Following the December 22, 2008 dike failure at the Tennessee Valley Authority's Kingston, Tennessee coal combustion waste (CCW) ash pond dredging cell that resulted in a spill of over 1 billion gallons of coal ash slurry, covering more than 300 acres that impacted residences and infrastructure, the United States Environmental Protection Agency (USEPA) is embarking on a initiative to prevent the catastrophic failure from occurring at other facilities located at electrical utilities in an effort to protect lives and property from the consequences of a dam failure or the improper release of impounded slurry.

This assessment of the stability and functionality of the Crisp County Power Commission - Plant Crisp ash management unit is based on a review of very limited available documents and site a assessment conducted by CDM Smith on August 30, 2012. In summary, the Plant Crisp ash impoundment embankments are rated as **POOR** for continued safe and reliable operation, because static and seismic engineering studies following the best professional engineering practice to support acceptable safety factors have not been presented. However, a **FAIR** classification and acceptable performance is expected with minor remedial actions and providing that analyses documenting structural stability under all required loading conditions is conducted.

It is critical to note that the condition of the embankments depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the embankments will continue to represent the condition of the embankments at some point in the future. Only through continued care and inspection can there be a chance that unsafe conditions will be detected.

1.2 Purpose and Scope

CDM Smith was contracted by the USEPA to perform site assessments of selected surface impoundments. As part of this contract, CDM Smith conducted a site assessment of the Plant Crisp Ash Pond. This pond is located to the west of the power generation plant and southwest of the existing hydroelectric dam on Lake Blackshear. The purpose of this report is to provide the results of our assessment and evaluation of the site conditions and potential for waste release from the management unit.

A site visit was conducted by CDM Smith representatives on August 30, 2012 to collect relevant information, and perform a visual assessment of the management unit.

1.3 Conclusions and Recommendations

1.3.1 Conclusions

The following conclusions are based on our visual observations during the site assessment on August 30, 2012 and a review of the very limited documentation provided by the Crisp County Power Commission.

1.3.1.1 Conclusions Regarding Structural Soundness of the Management Unit

The management unit appears to be structurally sound based on our visual observations of the structural components (i.e. inlet structures, earth embankments and outlet structures). No documentation to evaluate and assess structural stability and soundness of the impoundment was provided.

1.3.1.2 Conclusions Regarding the Hydrologic/Hydraulic Safety of Management Unit

Supporting technical documentation was not provided. No probable maximum precipitation (PMP) analysis required under Federal Emergency Management Agency (FEMA) standards was provided.

1.3.1.3 Conclusions Regarding Adequacy of Supporting Technical Documentation

Supporting data and documentation have not been provided. Liquefaction potential analyses for embankment foundations have not been performed, and complete original record drawings for the Ash Pond were not provided.

1.3.1.4 Conclusions Regarding Description of the Management Unit

The description of the management unit provided by a Crisp County Power Commission representative was generally consistent with the visual observations by CDM Smith during our site assessment. However, only four (4) sheets of miscellaneous drawings and survey data were provided, making it difficult to assess discrepancies compared to the intended design of the management unit. The drawings that were provided are included in Appendix A.

1.3.1.5 Conclusions Regarding Field Observations

During our visual observations and site assessment, signs of areas of erosion, erosion rills and scarps, were observed on the exterior and interior slopes of the embankments. There were no apparent unsafe conditions or conditions in need of immediate remedial repair observed.

1.3.1.6 Conclusions Regarding Adequacy of Maintenance and Methods of Operation

Current maintenance and operating procedures appear to be adequate. There was no evidence of previous spills or release of impounded coal ash slurry outside of the impoundment.

1.3.1.7 Conclusions Regarding Adequacy of Surveillance and Monitoring Program

The impoundment at Plant Crisp was permitted under the National Pollutant Discharge Elimination System (NPDES) Permit No. GA0025399 issued by the State of Georgia Department of Natural Resources, Environmental Protection Division, dated September 23, 2005. The permit authorized discharge into Lake Blackshear (Flint River Basin) in accordance with effluent limitations and monitoring requirements under the conditions set forth in the permit. Data to verify discharge and monitoring was not provided to CDM Smith. The permit expired on August 31, 2010, however, we were informed that the Crisp County Power Commission is in the process of getting it renewed.

1.3.1.8 Conclusions Regarding Suitability for Continued Safe and Reliable Operation

The embankments do not show evidence of unsafe conditions requiring immediate remedial efforts, although maintenance to correct the deficiencies noted above is required.

1.3.2 Recommendations

Based on CDM Smith visual assessment of the Ash Pond management unit and a review of limited documentation provided by Crisp County Power Commission, the following recommendations are provided.

A complete set of record drawings and/or as-built drawings should be developed or made readily available for future reference.

1.3.2.1 Recommendations Regarding the Hydrologic/Hydraulic Safety

It is recommended that a qualified professional engineer assist the Crisp County Power Commission to evaluate the hydrologic and hydraulic capacity of the management unit to withstand design storm events, without overtopping.

1.3.2.2 Recommendations Regarding the Technical Documentation for Structural Stability

It is recommended that a qualified professional engineer assist Crisp County Power Commission in the evaluation of the Ash Pond's embankments stability, including liquefaction analyses.

1.3.2.3 Recommendations Regarding Field Observations

Erosion rills and scarps – Erosion rills and scarps were observed on the exterior and interior slopes of the west embankment. Structural fill should be placed and compacted in the rills and scarps and the repaired areas graded to meet the adjacent existing contours. After slope restoration, it is recommended that the exposed surface of the embankment be stabilized with sod, or hydro seeding to restore vegetation cover on the face of the slopes.

Animal burrows were not observed on the embankments exterior slopes. Although not seen vegetation cover may have hidden animal burrows, therefore it is recommended that vegetation be maintained at a height that potential animal burrows can be readily observed.

1.3.2.4 Recommendations Regarding Surveillance and Monitoring Program

Monitoring the embankment slopes and crests for erosion, movement, animal burrows, and seepage is recommended. Although no discharge into Lake Blackshear (Flint River Basin) was observed, surveillance and monitoring in accordance with effluent limitations set forth in the NPDES Permit is recommended.

1.3.2.5 Recommendations Regarding Continued Safe and Reliable Operation

Inspections should be made following periods of heavy and/or prolonged rainfall, and the occurrence of these events should be documented. Inspection records should be retained at the facility for a minimum of three years.

Major repairs and slope restoration should be designed by a registered professional engineer experienced with earthen dam design.

None of the conditions observed during our site visit require immediate attention or remediation. However, the recommendations in this report should be implemented in a reasonable time frame to maintain continued safe and reliable operation of the management unit.

1.4 Participants and Acknowledgment

1.4.1 List of Participants

CDM Smith representatives William Fox, P.E. and Eduardo Gutiérrez-Pacheco, P.E. met with representatives of Crisp County Power Commission before and after our visual assessment. The representatives of the Crisp County Power Commission were Mr. Joe Rogers, Maintenance Supervisor, and Mr. Gene Ford, Manager of Production.

1.4.2 Acknowledgement and Signature

CDM Smith acknowledges that the Ash Pond, management unit referenced herein was assessed by William L. Fox, P.E. and Eduardo Gutiérrez-Pacheco, P.E. Based on the limited documentation provided, the Ash Pond are rated **POOR** because the facility lacks static, hydrologic and seismic engineering studies following best professional engineering practice to support safety factors under normal loading conditions (static, hydrologic, seismic) in accordance with the applicable safety regulatory criteria. Minor deficiencies exist that require remedial measures.

We certify that the management unit referenced herein was assessed on August 30, 2012.

Eduardo Gutiérrez-Pacheco, P.E. (FL)
Geotechnical Engineer

E. Woody Lingo, P.E.
Senior Geotechnical Engineer
Georgia Registration No. 6374

Section 2

Description of the Coal Combustion Waste Management Unit

2.1 Location and General Description

Plant Crisp is located near the border of Crisp and Worth Counties, Georgia, approximately 12 miles southwest of the City of Cordele. The power plant site is on the south bank of Lake Blackshear (Flint River Basin), and as shown on the USGS Quadrangle Map, **Figure 1**, is in Worth County. Critical infrastructure located within approximately five miles down gradient of the Plant Crisp is shown on **Figure 2**.

Plant Crisp's coal combustion waste (CCW) impoundment consist of the Ash Pond located to the west of the power generation plant and southwest of the existing hydro-electric power dam.

An aerial view of the Plant Crisp including the Ash Pond, Coal Stockpile, Admin Building, Hydro-electric power dam and power generation plant, is shown on **Figure 3**. The total perimeter of the embankments for the Ash Pond is approximately 2,500 feet; this pond has an approximate surface area of 7.3 acres. **Table 1** provides a summary of the approximate size and dimensions of the Ash Pond..

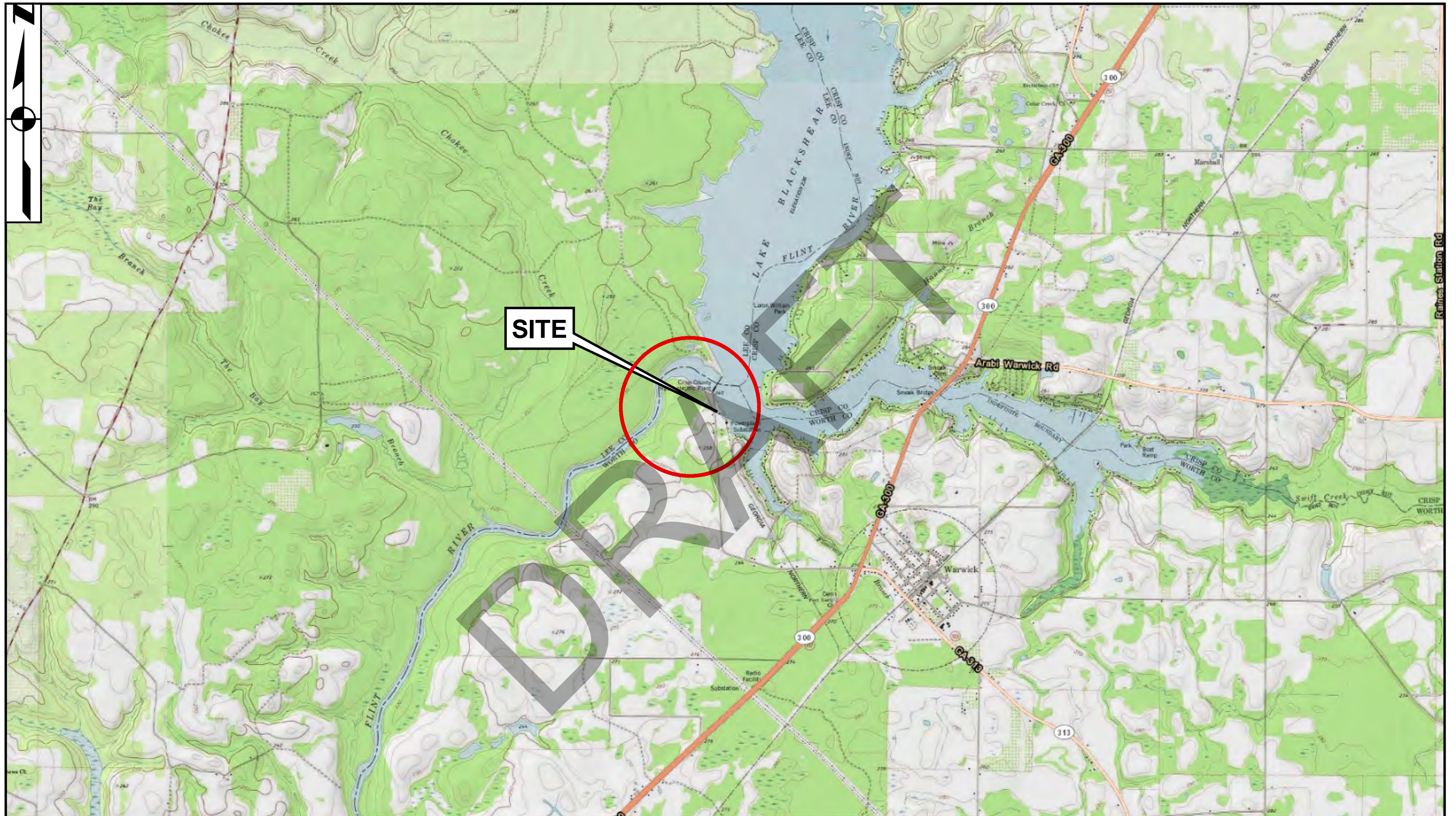
Table 1 – Summary of the Ash Pond Approximate Dimensions and Size

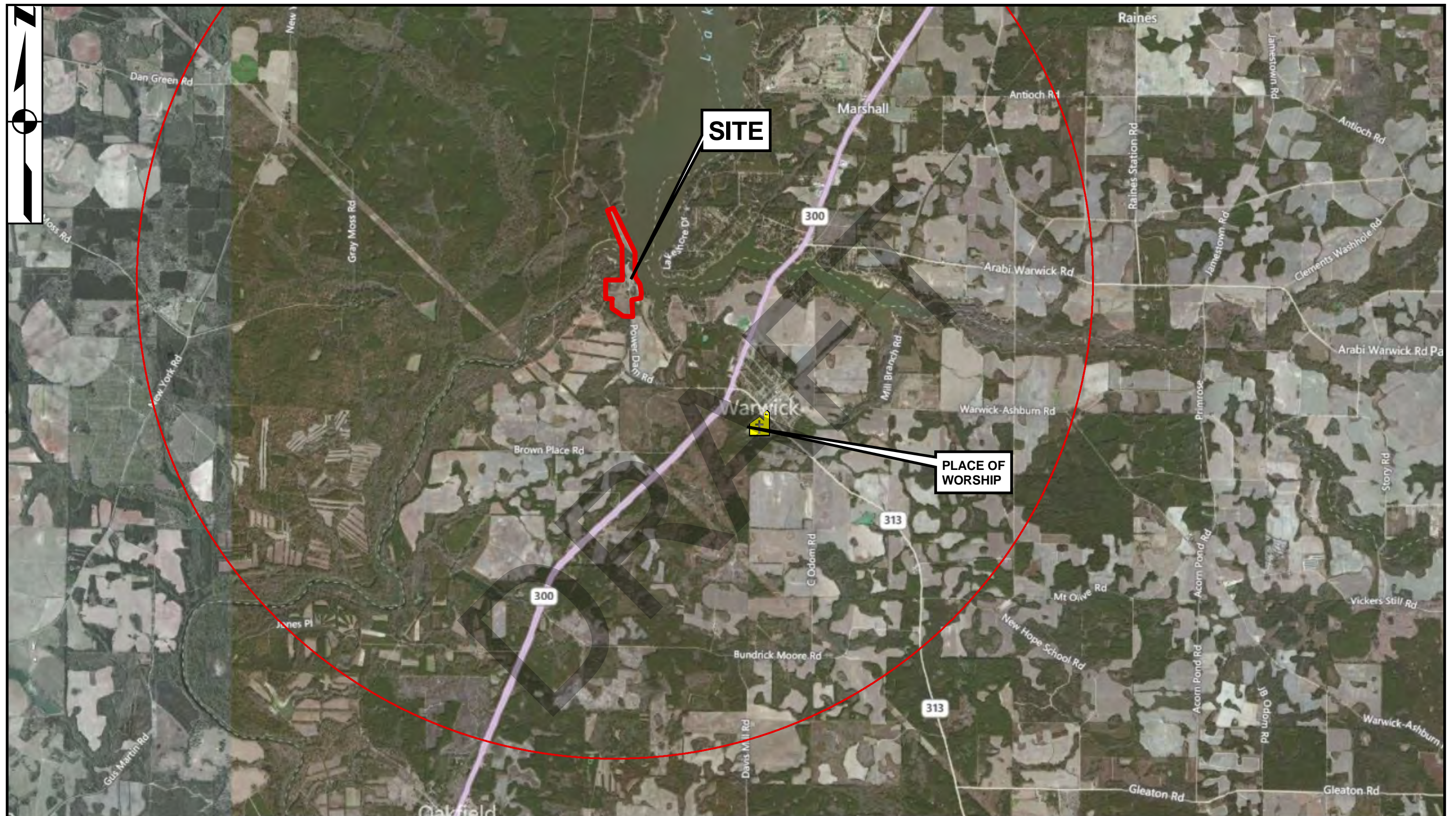
	Ash Pond			
	North Embankment	West Embankment	South Embankment	Southeast Embankment
Approximate Maximum Embankment Heights (ft)	22	16	10	5
Typical Crest Widths (ft)	15	17	16	16
Approximate Lengths (ft)	850	500	510	640
Estimated Interior Slopes H:V	2:1	2:1	3:1	5:1
Estimated Exterior Slopes H:V	2:1	2:1	5:1	4:1

2.1.1 Horizontal and Vertical Datum

The site survey provided by Crisp County Power Commission to CDM Smith is assumed to use the horizontal and vertical control network established by the National Geodetic Survey (NGS).

Horizontal survey data in this report reference the North American Datum (NAD) of 1983, 2007 adjustment. Elevations noted herein are in feet, and are referenced to 1929 National Geodetic Vertical Datum (NGVD 29), unless otherwise noted.





LEGEND

 5 Miles Radius for Ash Impoundment

0 2,500 5,000 10,000 15,000 20,000 Feet

FIGURE-2
CRITICAL INFRASTRUCTURE PLAN
CRISP COUNTY POWER COMMISSION - PLANT CRISP
WARWICK, GEORGIA



2.1.2 Site Geology

Plant Crisp is located on the southwestern embankment of Lake Blackshear in Worth County, Georgia. Based on review of the Warwick, GA 7.5-Minute USGS Topographic Quadrangle Map, the natural ground surface elevation in the area of the Ash Pond is approximately El. 250 feet. According to the Geologic Map of Georgia and the Geo-hydrology map of Sumter, Dooly, Pulaski, Lee, Crisp, and Wilcox Counties, Georgia, Plant Crisp is underlain by the Holocene-aged Flint River alluvium and the Eocene-aged Ocala Limestone. These two groups consist of soils deposited in very recent fluvial depositional environments overlying soils deposited in ancient marine depositional environments. The overlying alluvium is lithologically diverse with a combination of sand, gravel, silt, clay, and organic material that is pale yellowish-gray to dark-gray in color. These deposits are the result of the meandering and dendritic floodplains and terraces of the Flint River before it was dammed. The lithology of the underlying formation consists of a white to cream colored, relatively pure limestone with the basal beds commonly being a sandy limestone.

Subsurface information for Plant Crisp and within the Ash Pond embankments was not provided. The drawings and expired NPDES permit that were provided by Crisp County Power Commission is included in **Appendix A**.

2.2 Coal Combustion Residue Handling

Plant Crisp disposes the CCW in the Ash Pond. The Ash Pond receives any residual sluiced ash, waste water from the plant process and coal pile runoff. Overflow from the pond discharges through an 18-inch corrugated metal riser pipe located near the north embankment and discharges into Flint River Basin.

2.3 Size and Hazard Classification

According to the United States Army Corps of Engineers (USACE) Guidelines for Safety Inspection of Dams (1979), the impoundments may be placed in the size classification per **Table 2**.

Table 2 – USACE ER 1110-2-106 Size Classification

Category	Impoundment	
	Storage (Ac-ft)	Height (Ft)
Small	50 to < 1000	25 to < 40
Intermediate	1000 to < 50,000	40 to < 100
Large	> 50,000	> 100

Based on storage capacity and embankments height, the Plant Crisp impoundment is considered a SMALL impoundment.

It is not known if the Plant Crisp impoundment currently has a Hazard Potential Classification. Based on the USEPA classification system as presented on Page 2 of the USEPA checklist (**Appendix B**) and our review of the site and downstream areas, a recommended hazard rating has been assigned to the impoundment as summarized in **Table 3**:

Table 3 – Recommended Impoundment Hazard Classification Rating

Impoundment	Recommended Hazard Rating	Basis
Ash Pond	Low Hazard	<ul style="list-style-type: none"> Failure or mis-operation would result in low economic loss and environmental damage to adjacent waterways and downstream areas. Losses will be limited to Owner's property. Loss of human life as a result of failure is not anticipated.

2.4 Amount and Type of Residuals Currently Contained in the Unit and Maximum Capacity

At the time of the assessments, CDM Smith did not have information on the amounts of residuals currently stored in the unit. The pool area of the Ash Pond is approximately 6.5 acres. The Ash Pond receive process water from plant operations, including cooling tower blow down, plant drains, industrial process water, and sluiced bottom ash.

2.5 Principal Project Structures

The primary components of the Ash Pond include the following:

- A 8-inch diameter PVC inlet pipe located at the southeast embankment,
- A 7-inch inside diameter ductile iron inlet pipe,
- Earth perimeter embankments
- An 18-inch corrugated metal pipe outlet structure with a 30-inch diameter trash-rack on the north embankment.

2.6 Critical Infrastructure within Five Miles Down Gradient

Based on available topographic maps, surface drainage in the vicinity of Plant Crisp appears to be towards the north and northwest through a wooded area in the direction of the Flint River. Critical infrastructure that was identified within five miles of Plant Crisp includes the 17.2 MW Lake Blackshear hydro-electric project, Lake Blackshear and the Flint River Basin, and GA Route 300. This 4-lane divided highway extends from I-75, immediately south of Cordele to Albany, GA, and it is less than two miles from the plant generally to the east and south.

The town of Warwick, Georgia is located approximately 1.5 miles southeast from Plant Crisp.

A breach of the impoundment embankments would most likely impact low-lying lands surrounding the Ash Pond and is not expected to result in loss of human life.

Section 3

Summary of Relevant Reports, Permits and Incidents

3.1 Summary of Reports on the Safety of the Management Unit

At the time of CDM Smith's on-site assessment, no safety reports on the management unit were available. According to plant representatives, there have been no known structural or operational problems associated with the impoundment, however no supporting documentation was available.

3.2 Summary of Local, State, and Federal Environment Permits

Currently, the coal combustion waste (CCW) impoundment is regulated by the State of Georgia, Department of Natural Resources, Environmental Protection Division (GAEPD).

Plant Crisp was issued a permit under the National Pollutant Discharge Elimination System (NPDES) authorizing discharge to the Lake Blackshear (Flint River Basin) in accordance with effluent limitations, monitoring requirements, and other conditions set forth in the permit. The permit was issued on September 23, 2005, by the State of Georgia, permit number is GA0025399. The permit expired on August 31, 2010, however we were informed that the Crisp County Power Commission is in the process of renewing the permit.

3.3 Summary of Spill/Release Incidents

According to plant representatives, there have been no known spills or releases related to the impoundment. No documentation was available to confirm or disprove this statement.

Section 4

Summary of History of Construction and Operation

4.1 Summary of Construction History

4.1.1 Impoundment Construction and Historical Information

Plant Crisp began operation in 1930, producing power at the Blackshear hydroelectric facility. Over time the demand for power exceeded the capacity of the hydroelectric facility and in 1957 the Commission constructed a combined cycle facility consisting of a 12.5 megawatt (MW) coal generator and a 5 MW natural gas combustion turbine.

Based on our understanding and the limited available data, it appears that the Ash Pond was constructed in the 1970's. The Ash Pond was constructed by the placement of embankments around the perimeter to form the pond. The embankments were constructed, starting at grade or a few feet below the original ground surface elevations at the northeast corner of the pond. The dike perimeter crest elevation of the Ash Pond is estimated to be about El. 250.

Based on the limited drawings that were provided, the exterior and interior slopes of the impoundment were to be constructed at 3H:1V, as designed by the U.S. Department of Agriculture, Soil Conservation Service, March, 1973. A complete set of drawings was not available for CDM Smith's review. Based on information provided by Crisp County Power Commission, and CDM Smith visual observations, the Ash Pond perimeter embankments have a crest width that generally varies from about 10 to 20 feet.

Information regarding the soils that were used for the embankment construction was not available. An 8-foot wide cutoff trench is shown for a portion of the north and west embankments in the drawings provided. Details regarding the detailed design, materials used and methods of constructing the embankments were not provided.

Drawings provided by Crisp County Power Commission showing a typical cross section of the embankments are presented in **Appendix A**.

4.1.2 Significant Changes/Modifications in Design since Original Construction

Reportedly, there have not been significant changes or modifications in the design. There was no documentation provided that indicates any changes or modifications to the original design. However, based on visual observations, estimated exterior and interior slopes, and crest width seems to be inconsistent with the cross section provided in the drawings.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

Information regarding major repairs or rehabilitation to the embankments of the Ash Pond was not provided. No evidence of prior releases, failures or remedial work was observed on the embankments during the CDM Smith visual assessment. There was no documentation provided that indicates any repairs or rehabilitation has occurred since the original construction.

4.2 Summary of Operational Procedures

4.2.1 Original Operating Procedures

The Ash Pond at Plant Crisp has historically been used as a settling pond for CCW and other plant wastes such as:

- Industrial process water including sluiced bottom ash
- Cooling tower blow down water
- Plant drains
- Plant runoff

4.2.2 Significant Changes in Operational Procedures and Original Startup

No significant changes in the operational procedures appear to have been made to the Ash Pond. There was no documentation provided that indicates there have been any changes in operation procedures since start-up.

4.2.3 Current CCW Impoundment Configuration

Current operational procedures of the Ash Pond appear to be consistent with the original operating procedures.

The approximate crest elevation of the embankments is El. 250 and the pond area is 6.5 acres. It is our understanding that the normal pool elevation was intended to be 2 feet below the crest.

4.2.4 Other Notable Events since Original Startup

No additional information was provided to CDM Smith regarding other notable events, which have impacted operations and /or regular maintenance and inspection of the Ash Pond.

Section 5

Field Observations

5.1 Project Overview and Significant Findings (Visual Observations)

CDM Smith has performed a visual assessment of the CCW impoundment at the Crisp County Power Commission – Plant Crisp. The management unit assessed is known as the Ash Pond. The perimeter embankments of the management unit are approximately 2,500 feet in length and vary from approximately 5 to 23 feet in height. The assessment was completed following the general procedures and considerations contained in the Federal Emergency Management Agency (FEMA) Federal Guidelines for Dam Safety (April 2004). These guidelines require that observations of embankment settlement, movement, erosion, seepage, leakage, cracking, and deterioration be performed. A Coal Combustion Dam Inspection Checklist and Coal Combustion Waste (CCW) Impoundment Inspection Form, developed by the USEPA, were completed for the impoundment. Copies of the completed forms are included in **Appendix B**. The locations of photographs that were taken during our field inspections are shown on **Figure 4**, and these photographs are included in **Appendix C**. The locations of the photographs were logged using a handheld GPS device and the coordinates are also listed in Appendix C.

CDM Smith visited the plant on August 30, 2012, to conduct visual assessments of the impoundment. The weather was generally cloudy with daytime high temperatures up to 80 degrees Fahrenheit. The daily precipitation for the week before and total precipitation for one month immediately prior to our site visit are shown in **Table 4**. This data was recorded at the National Oceanic and Atmospheric Administration (NOAA) Station 092266, in Cordele, Georgia, which is approximately 12 miles northeast of Plant Crisp.

Table 4 – Approximate Precipitation Prior to Site Visit

Date of Site Visit – August 30, 2012		
Day	Date	Precipitation (inches)
Wednesday	August 29	0.00
Tuesday	August 28	0.50
Monday	August 27	0.00
Sunday	August 26	0.00
Saturday	August 25	0.00
Friday	August 24	0.00
Thursday	August 23	0.02
Total	Month Prior to Site Visit (July 31 to August 29, 2012)	0.98

Note: Precipitation data from www.nws.noaa.gov. Station Location ID: 092266 at Cordele, Georgia. Lat. 31.983333; Lon.-83.766666; EL. 308 feet



5.2 Ash Pond

At the time of the assessment, the Ash Pond contained residual ash and a limited amount of standing water near the northwest corner of the pond (Photograph 68). The bottom of the pond was covered with well maintained vegetative cover. It was indicated by the Crisp County Power Commission staff that the Ash Pond has never been dredged to remove accumulated ash. Approximately 8 feet of freeboard was available near the northwest corner of the pond, where water was observed. The Ash Pond has a side-hill configuration, with the north and west embankments being the highest at about 23 feet above the exterior grade.

5.2.1 Crest

The crest of the perimeter embankments appeared to be in **SATISFACTORY** condition (Photographs 1, 34, 37, 40, 41, 46, 48 and 58). The crest width varies from about 15 and 20 feet. The crest of the embankments has a grass cover that was about 4 to 6 inches high. Reportedly, the crest is exposed to very limited vehicle traffic, only during maintenance operations. No signs of cracks, erosion, scarps, depressions or evidence of settlement were observed on the crest of any of the embankments.

5.2.2 Interior Slopes

The interior slopes of the Ash Pond embankments appear to be in **FAIR** condition. The interior slopes vary from about 2H:1V at the north and west embankments, 3H:1V at the south embankment to 5H:1V at the southeast embankment. Slopes shown on the drawings provided are 3H:1V. Interior slopes have a vegetation cover (Photographs 4, 9, 10, 42, 43, 57, 60, 67, 71 and 72). Scarps and erosion rills (Photographs 50, 59, 61, 62, 66, 70 and 75) were observed along the interior slopes of the north, west and south embankments. Several boulders (rocks with size greater than 12 inches) protruding from the face of the slope (Photographs 65 and 73) were observed on the north and south embankments. Near the southeast embankment, accumulated ash and debris were clearly visible (Photograph 53).

The Ash Pond has two inlet pipes located on the southeast embankment (Photographs 4, 51, and 55); one, 8-inch polyvinyl chloride (PVC) pipe and one, 7-inch inside diameter ductile iron pipe (DIP). During the visual assessment water from the plant was discharging through the 8-inch PVC pipe (Photograph 63).

5.2.3 Exterior Slopes

The exterior slopes appear to be in **FAIR** condition. The exterior slopes of the embankments vary from 2H:1V at the north and west embankments, 5H:1V at the south embankment and 4H:1V at the southeast embankment. The east portion of the north embankment has an approximate slope of 3H:1V with a slope break near the outlet structure to 2H:1V (Photograph 6). Slopes shown on the drawings provided are 3H:1V. The exterior slopes are covered with low height vegetation which was approximately 4 to 6 inches high at the time of the visual assessment (Photographs 14 to 17, 31, 32, 38, 39, 44 and 45). Surficial erosion rills and scarps were observed at the north embankment (Photographs 5, 7 and 8). An apparent 16-foot long semicircular surficial sloughing zone (Photographs 21 to 23) and several minor sloughing areas and scarps near the crest (Photograph 18, 19, 20, and 24 to 27) were observed on the west embankment.

A runoff swale was cut into the toe of the slope of the west embankment (Photographs 29 to 31). It was reported by the Crisp County Power Commission representatives that the toe of slope of the west embankment extends beyond the plant property line.

Animal burrows were not observed on the embankments during the visual assessment.

5.2.4 Outlet Structures

The outlet structure consists of an 18-inch diameter corrugated metal riser pipe (CMP), with an approximate 2-foot high 36-inch CMP trash-rack at the neck of the outlet pipe. This outlet is located near the central portion of the north embankment (Photographs 11, 12 and 64). Based on the drawings provided by the Crisp County Power Commission (Appendix A), we understand that this riser pipe connects into a 12-inch CMP and discharges near the toe of slope of the north embankment. CDM Smith was not able to locate the exit pipe due to the high vegetation at the apparent outfall/discharge location.

DRAFT

Section 6

Hydrologic/Hydraulic Safety

6.1 Impoundment Hydraulic Analysis

The State of Georgia Environmental Protection Division has established rules in regard to the hydrologic or hydraulic design of coal ash impoundments. FEMA standards require impoundments to have the capacity to store some percentage of the Probable Maximum Precipitation (PMP) for a 6-hour storm event over a 10 square-mile area in the vicinity of the site. Significant and high hazard structures are required to store 50 percent of the PMP and 100 percent of the PMP, respectively. For low hazard structures, impoundments are required to have capacity for at least 100-year, 24-hour return frequency storm event.

6.2 Adequacy of Supporting Technical Documentation

Hydrologic and hydraulic documentation and/or PMP analyses were not provided by Crisp County Power Commission for CDM Smith to review.

6.3 Assessment of Hydrologic/Hydraulic Safety

Hydrologic and hydraulic safety of the management units appears to be FAIR based on the following:

- Reportedly, overtopping of the embankments has never occurred. During our visual observations and site assessment, no signs of plugged, collapsed or blocked pipes, or other detrimental conditions were observed at the Ash Pond.
- Signs of scarps and erosion were observed on the exterior slope of the west embankment and the interior slopes of the north embankment. However, these conditions do not indicate an immediate potential of embankment failure.
- In general, the pond was relatively dry (limited water was standing at the bottom of pond near the northwest corner). At least 8 feet of freeboard was observed at the time of the assessment. An emergency spillway is located near the northeast corner of the pond.

Hydrologic/hydraulic documentation or PMP analyses were not provided, therefore the Ash Pond unit is rated as **POOR**. EPA requirements state that “if a facility has not conducted hydrologic, static and seismic engineering studies following best professional engineering practice to support factors of safety, the facility must be rated POOR”.

Section 7

Structural Stability

7.1 Supporting Technical Documentation

The Crisp County Power Commission did not provide CDM Smith with slope stability analyses or technical documentation to support the embankments structural stability.

7.1.1 Stability Analyses and Load Cases Analyzed

The GAEPD programs and regulations that relate to coal ash impoundments include Georgia's Subtitle D program, the Georgia Safe Dams program and the Georgia NPDES permitting process. The Rules of Georgia, Department of Natural Resources, Environmental Protection Division, Chapter 391-3-4, Solid Waste Management also contain sections that relate to the disposal of coal ash. In addition, procedures have been established by the United States Army Corps of Engineers (USACE), the United States Bureau of Reclamation, the Federal Energy Regulatory Commission, and the Natural Resources Conservation Service as accepted engineering practice in regard to dams and impoundments. The minimum required factors of safety outlined by the USACE in EM 1110-2-1902, Table 3-1 and seismic factors of safety by FEMA Federal Guidelines for Dam Safety, Earthquake Analyses and Design of Dams (pgs. 31, 32 and 38, May 2005) are provided in **Table 5**.

Table 5 - Minimum Safety Factors

Load Case	Minimum Required Factor of Safety
Steady-State Condition at Normal Pool or Maximum Storage Pool Elevation	1.5
Rapid Drawdown Condition from Normal Pool Elevation	1.3
Maximum Surcharge Pool (Flood) Condition	1.4
Seismic Condition at Normal Pool Elevation	1.1
Liquefaction	1.3

Notes: Above safety factors are based on requirements established by the USACE. It is our belief that required safety factors have not been established by the State of Georgia for coal ash impoundments.

7.1.2 Design Parameters and Dam Materials

General soil properties and soil parameters that may have been used for the slope stability or design of the embankments were not provided to CDM Smith for review.

7.1.3 Uplift and/or Phreatic Surface Assumptions

Since no stability analyses were provided, uplift and/or phreatic surface assumptions were not available.

7.1.4 Factors of Safety and Base Stresses

Factors of safety and base stresses were not available for review.

7.1.5 Liquefaction Potential

Documentation provided by the Crisp County Power Commission did not include an evaluation of liquefaction potential.

7.1.6 Critical Geological Conditions

Based on the review of U. S. Geological Survey Maps and readily available information, critical geological conditions for Plant Crisp were not identified. Based on the 2008 USGS National Seismic Hazard Map, a Peak Ground Acceleration (PGA) of 2% probability of exceedance in 50 years indicates that Georgia is in the low hazard potential area for seismic activity.

7.2 Adequacy of Supporting Technical Documentation

Structural stability and liquefaction documentation were not provided.

7.3 Assessment of Structural Stability

Existing conditions and our visual observations would yield a FAIR rating for structural stability of the Ash Pond based on the following:

- It is apparent that critical studies or investigations have not been performed to confirm that potential safety deficiencies do not exist. Additional documentation and/or supplemental evaluations should be performed to confirm that the condition and performance of the impoundment is sufficient to substantiate an improved condition assessment.
- Stability analyses on different cross sections representing the typical embankments and liquefaction analyses are required in order to obtain a FAIR rating for structural stability. Such analyses were not provided.
- During our visual observations and site assessment, shallow scarps and minor erosion areas were observed on the exterior slope of the west embankment and the interior slope of the north embankment.
- No indications of seepage along the exterior slopes or along the toe of slopes of the embankments were observed.

Because of the lack of documentation and analyses the assessed rating is **POOR**. A poor rating is assigned when a dam safety deficiency is recognized for loading conditions that may realistically occur and remedial action is necessary. Also, if a facility has not conducted static and seismic engineering studies following the best professional engineering practice to support Factors of Safety, the facility must be rated as **POOR**.

Section 8

Adequacy of Maintenance and Methods of Operation

8.1 Operating Procedures

As described in Section 2, the Ash Pond receives any residual sluiced ash, plant process wastewater and coal pile runoff water. Overflow from the pond discharges through an 18-inch corrugated metal riser pipe located near the north embankment and discharges into the Flint River Basin floodplain.

8.2 Maintenance of the Dam and Project Facilities

Reportedly, the Crisp County Power Commission performs inspections and maintenance of the embankments. These inspections were reported to occur on a weekly basis and any other day during a plant operation walk-around. Records of these inspections were not provided.

8.3 Assessment of Maintenance and Methods of Operations

8.3.1 Adequacy of Operating Procedures

Based on CDM Smith's visual observations and the verbal information provided by Crisp County Power Commission, the operating procedures are considered to be **POOR**; written documentation was not provided and unaddressed maintenance issues (i.e. erosion rills and scarps) were observed.

8.3.2 Adequacy of Maintenance

No major maintenance issues that would appear to compromise the structural stability and operation of the Ash Pond were identified. The embankments appear to be performing in a **FAIR** condition. However, based on the lack of documentation provided and minor deficiencies previously described herein, the maintenance procedures must be rated as **POOR**.

Section 9

Adequacy of Surveillance and Monitoring Program

9.1 Surveillance Procedures

Reportedly, the Crisp County Power Commission inspects the embankments on a weekly basis and on other days when a non scheduled operations walk-around occurs. However, CDM Smith was not provided with inspection logs or inspection reports which support this statement.

9.2 Instrumentation Monitoring

Based on CDM Smith visual assessment and verbal information provided by Crisp County Power Commission, we understand that there is no instrumentation monitoring for the Ash Pond. No written documentation or monitoring records were provided to CDM Smith.

9.3 Assessment of Surveillance and Monitoring Program

9.3.1 Adequacy of Inspection Programs

Based on our visual observations and verbal information provided by the Crisp County Power Commission during the site assessment, the inspection program appears to be adequate. No condition that needs immediate remedial action was observed. However, as previously noted there is a lack of written documentation on regular maintenance issues and surveillance of the Ash Pond.

9.3.2 Adequacy of Instrumentation Monitoring Program

As mentioned, there is no instrumentation on the embankments. Detrimental conditions or indications of potential failure of the embankments were not observed during CDM Smith's visual assessment.

Section 10

Reports and References

The following is a list of documents and drawings that were provided by the Crisp County Power Commission that were used during the preparation of this report and the development of the conclusions and recommendations presented herein. These documents are included in Appendix A.

1. Authorization to Discharge under the National Pollutant Discharge Elimination System, Permit No. GA0025399, State of Georgia, Department of Natural Resources, Environmental Protection Division, dated September 23, 2005
2. Ash Pond, Typical View of Dam Base Area, taken from Centerline of Dam Survey, Crisp County Power Commission Engineering Department, dated September 28, 1973
3. Crisp County Power Commission, Debris Basin, US Department of Agriculture Soil Conservation Service, Drawing (Plan, Cross Section, Profile Centerline of Embankment), dated March, 1973 and revised on January 7, 1974
4. Crisp County Power Commission, Engineering Department, Location Map, 15 MW Steam – Gas Turbine, Generating Station, Warwick, Georgia, dated November 8, 1956 (Revised August 24, 1972)
5. Survey Plat for Crisp County Power Commission, Worth County, Georgia, dated July 19, 1978

Appendix A

Data Provided by Crisp
County Power Commission

PERMIT NO. GA0025399

STATE OF GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Georgia Water Quality Control Act (Georgia Laws 1964, p. 416, as amended), hereinafter called the "State Act;" the Federal Water Pollution Control Act, as amended (33 U.S. C. 1251 et seq.), hereinafter called the "Federal Act;" and the Rules and Regulations promulgated pursuant to each of these Acts,

Crisp County Power Commission
202 South 7th Street
Cordele, Georgia 31015

is authorized to discharge from a facility located at

Crisp County Power Commission - Plant Crisp (SIC Code 4911)
961 Power Dam Road
Warwick, Worth County, Georgia 31796

to receiving waters

Lake Blackshear
(Flint River Basin)

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II and III hereof.

This permit shall become effective on September 23, 2005.

This permit and the authorization to discharge shall expire at midnight, August 31, 2010.

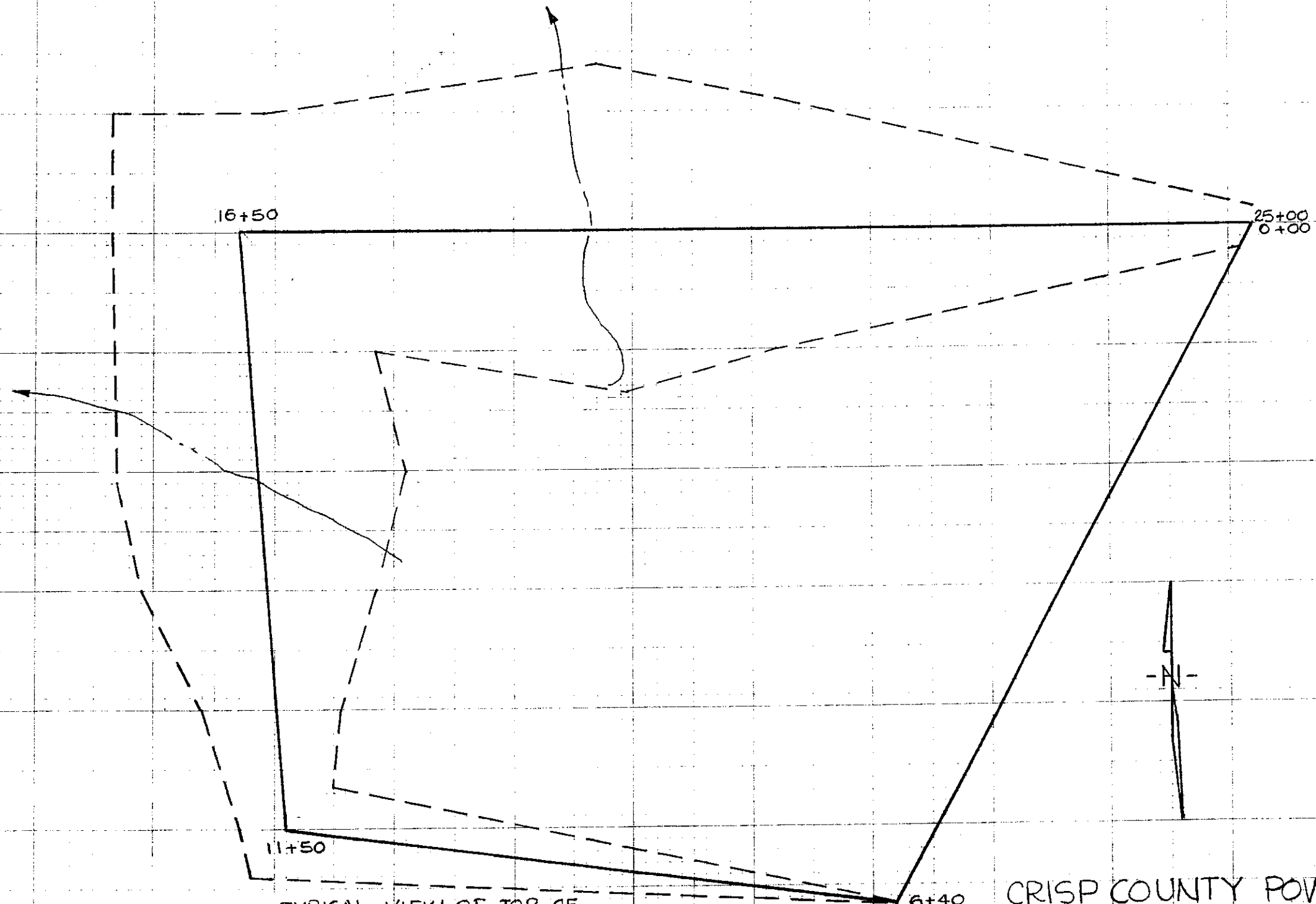
Signed this 23rd day of September, 2005.





Director,
Environmental Protection Division

CRISP COUNTY POWER COMMISSION
ENGINEERING DEPARTMENT
SP-1104
SHT. 2 OF 2



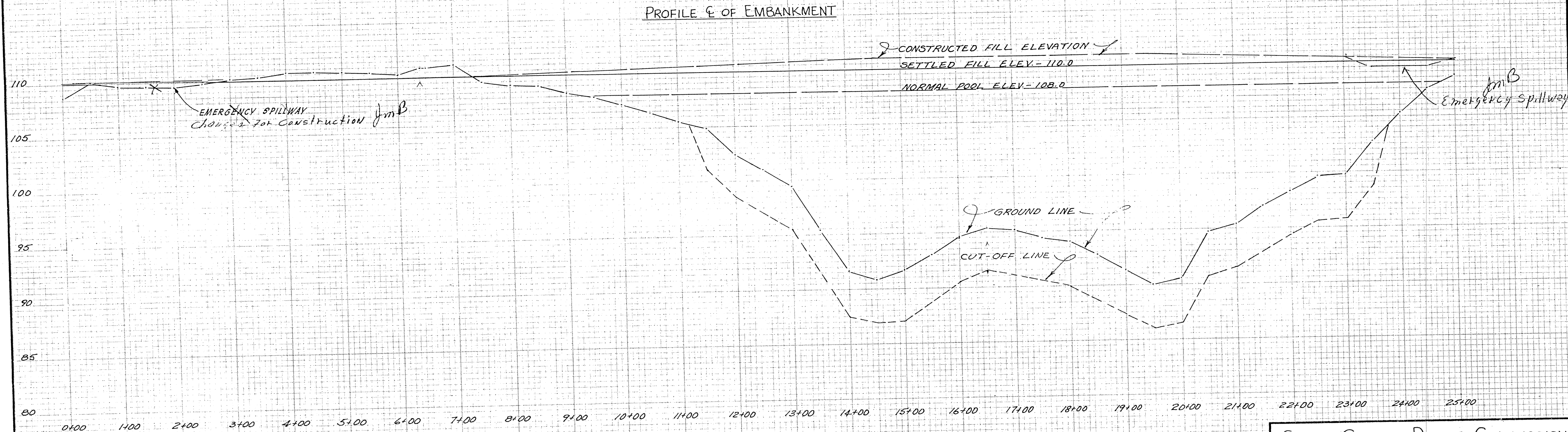
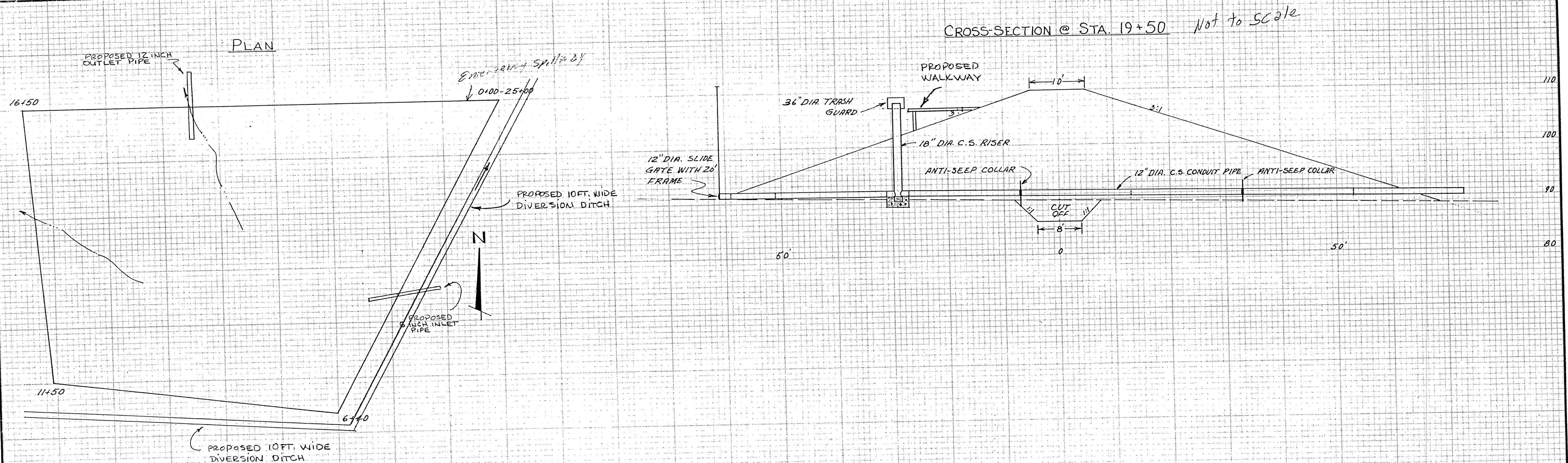
TYPICAL VIEW OF TOP OF
DAM BASE AREA, TAKEN FROM C OF DAM SURVEY
ASSUMING A FLAT CROSS SECTIONAL AREA - 3:1 SLOPES - 10' TOP WIDTH
SCALE: 1" = 100' - EXCEPT FOR THE WIDTH OF THE DOTTED
AREA ONLY, WHICH IS - 1" = 50'

CRISP COUNTY POWER COMMISSION
ENGINEERING DEPARTMENT

ASH POND

DRAWN BY JAG
9/28/73

SP-1104
SHT. 2 OF 2



BILL OF MATERIALS

CONCRETE 1 CU. YD.
 CONDUIT PIPE 12" DIA. CORR. STEEL 100 LIN. FT.
 RISER TEE 12"x12"x18" C.S. (17" WATER) 1 EACH
 ANTI-SEEP COLLARS 2 EACH
 TRASH GUARD 36" DIA. C.S. 1 EACH
 SLIDE GATE 12" DIA. 20" FRAME 1 EACH
 ALL PIPE SHALL BE CORRUGATED STEEL,
 FULLY ASPHALT COATED .05" AND
 ASBESTOS TREATED.

EARTH QUANTITIES

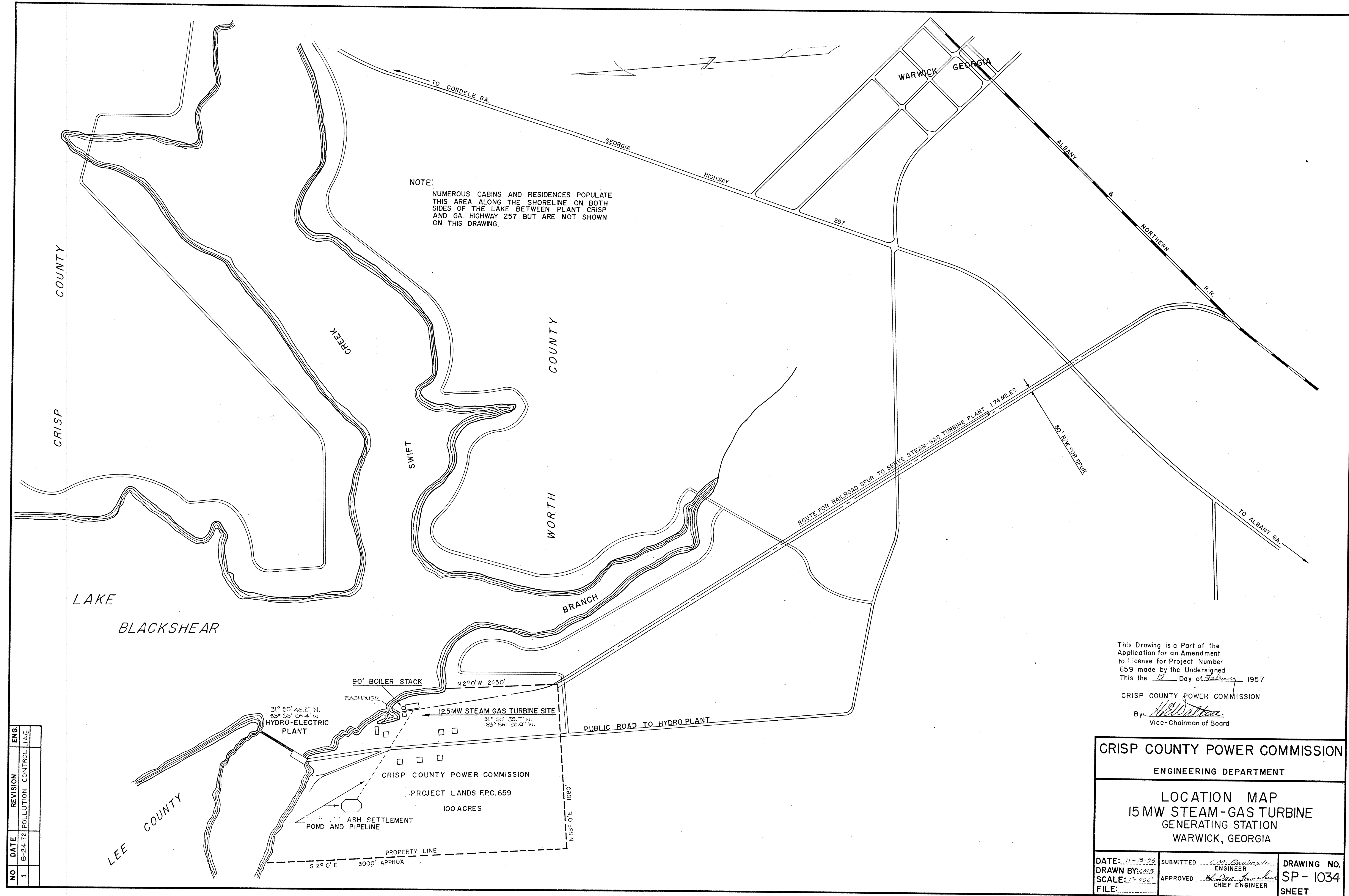
EMBANKMENT 39,600 CU. YDS.
 EXCAVATION CUT-OFF 1,800 CU. YDS.
 TRENCH 4,400 CU. YDS.
 TOTAL

CRISP COUNTY POWER COMMISSION
 DEBRIS BASIN

U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

Designed BRUNSON & ROBERTS 3-73
 Drawn P.F. DOMINY 3-73
 Traced _____
 Checked _____
 Date _____
 Approved by Perry F. Dominy
 Title AREA ENGINEER
 Sheet 1 of 2
 Drawing No. SP1104

REVISED JAN. 7, 1974
 CRISP POWER
 ENG. DEPT JAG

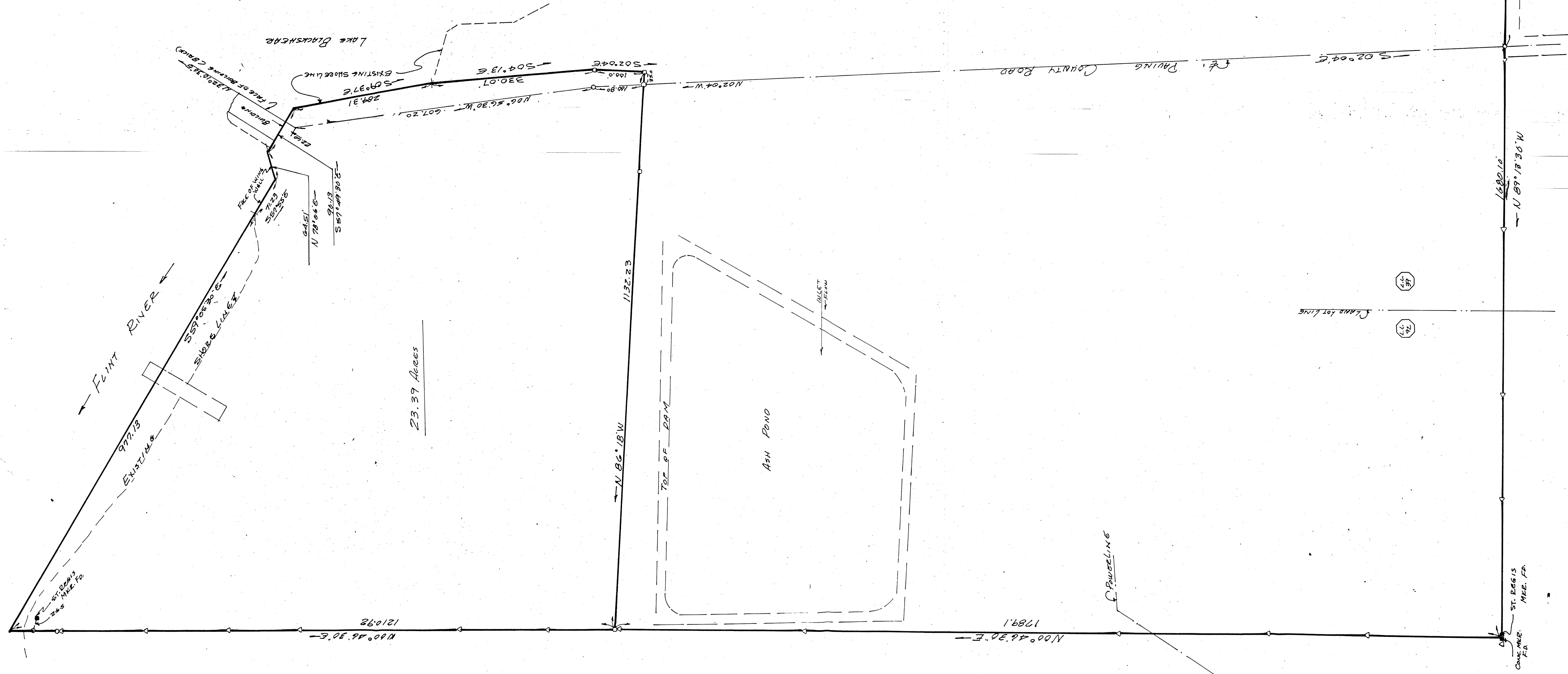


This Drawing is a Part of the
Application for an Amendment
to License for Project Number
659 made by the Undersigned
This the 12 Day of February 1957

CRISP COUNTY POWER COMMISSION

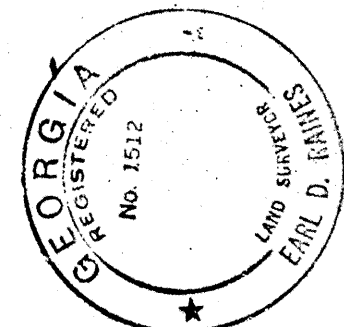
By: H. D. [Signature]
Vice-Chairman of Board

CRISP COUNTY POWER COMMISSION		
ENGINEERING DEPARTMENT		
LOCATION MAP 15 MW STEAM-GAS TURBINE GENERATING STATION WARWICK, GEORGIA		
DATE: <u>11-8-56</u>	SUBMITTED: <u>[Signature]</u> ENGINEER	DRAWING NO. SP-1034 SHEET
DRAWN BY: <u>[Signature]</u>	APPROVED: <u>[Signature]</u> CHIEF ENGINEER	
SCALE: <u>1"=400'</u>	FILE: _____	



I certify that this map or plat is a correct representation of the land plotted and has been prepared in conformity with the standards and requirements of law.

Earl D. Rains
Earl D. Rains
Georgia Registered Surveyor No. 1512



THE GUYANA ASSOCIATION OF
COUNTRIES IN
RECEIVED 1900

5. ☒ RAIL ROAD RAIL SET
 4. ☒ CONCRETE MARKER FOUND
 3. ☒ CONCRETE MARKER SET
 2. ☒ IRON PIPE FOUND
 1. ☒ IRON PIN SET
- NOTE:

SURVEY PLAT FOR
CRISP COUNTY POWER COMMISSION
IN LAND LOTS 39 & 42, 15TH LAND DISTRICT
NORTH COUNTY, GEORGIA
SCALE 1"=100'
19 JULY 1978
78-1876-4

Appendix B

USEPA Checklists



Site Name:	Crisp Plant	Date:	August 30, 2012
Unit Name:	Ash Pond	Operator's Name:	Crisp County Power Commission
Unit I.D.:		Hazard Potential Classification:	High Significant Low
Inspector's Name:	William Fox/ Eduardo Gutierrez		

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?		Weekly	18. Sloughing or bulging on slopes?	X	
2. Pool elevation (operator records)?		101.5	19. Major erosion or slope deterioration?	X	
3. Decant inlet elevation (operator records)?		DNA	20. Decant Pipes:		DNA
4. Open channel spillway elevation (operator records)?		DNA	Is water entering inlet, but not exiting outlet?	X	
5. Lowest dam crest elevation (operator records)?		109.5	Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?		X	Is water exiting outlet flowing clear?		DNA
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?		N/A	From underdrain?		DNA
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	X		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		DNA	Around the outside of the decant pipe?		DNA
15. Are spillway or ditch linings deteriorated?		DNA	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		DNA	23. Water against downstream toe?		X
17. Cracks or scarps on slopes?	X		24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
1.	Weekly and every other day by plant personnel during regular walk-arounds.
2.	Drawings show a design normal pool elevation of 108.0; Pond was dry at time of inspection, CCW was observed at the bottom of the pond with limited standing water at NW corner.
2,5.	Datum not available.
12.	36-inch diameter trash guard on 18-inch riser pipe.
17,18,19.	Shallow to moderately-deep scarps, sloughing and erosion were observed along inboard and outboard slopes of the embankments, mainly on the west side.
20.	Water was being pumped into impoundment but was not exiting through outlet.

**Coal Combustion Waste (CCW)
Impoundment Inspection**

Impoundment NPDES Permit # GA0025399 INSPECTOR William Fox and Eduardo Gutierrez
Date August 30, 2012

Impoundment Name Ash Pond
Impoundment Company Crisp County Power Commision
EPA Region 4
State Agency (Field Office) Addresss 61 Forsyth Street, SW
Atlanta, Ga 30303-8960

Name of Impoundment Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ☒ Update ☐

Is impoundment currently under construction?

Yes

No

Is water or ccw currently being pumped into the impoundment?

☒

☒

IMPOUNDMENT FUNCTION: Settling of CCW (bottom ash, fly ash, and runoff from plant) and some stormwater runoff

Nearest Downstream Town : Name Warwick, Georgia

Distance from the impoundment 1.5 miles

Impoundment

Location: Longitude 83 Degrees 56 Minutes 39.60W Seconds
Latitude 31 Degrees 50 Minutes 41.02N Seconds
State Georgia County Crisp County

Does a state agency regulate this impoundment? YES ☒ NO ☐

If So Which State Agency? Georgia Environmental Protection Division

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

_____ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

x **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

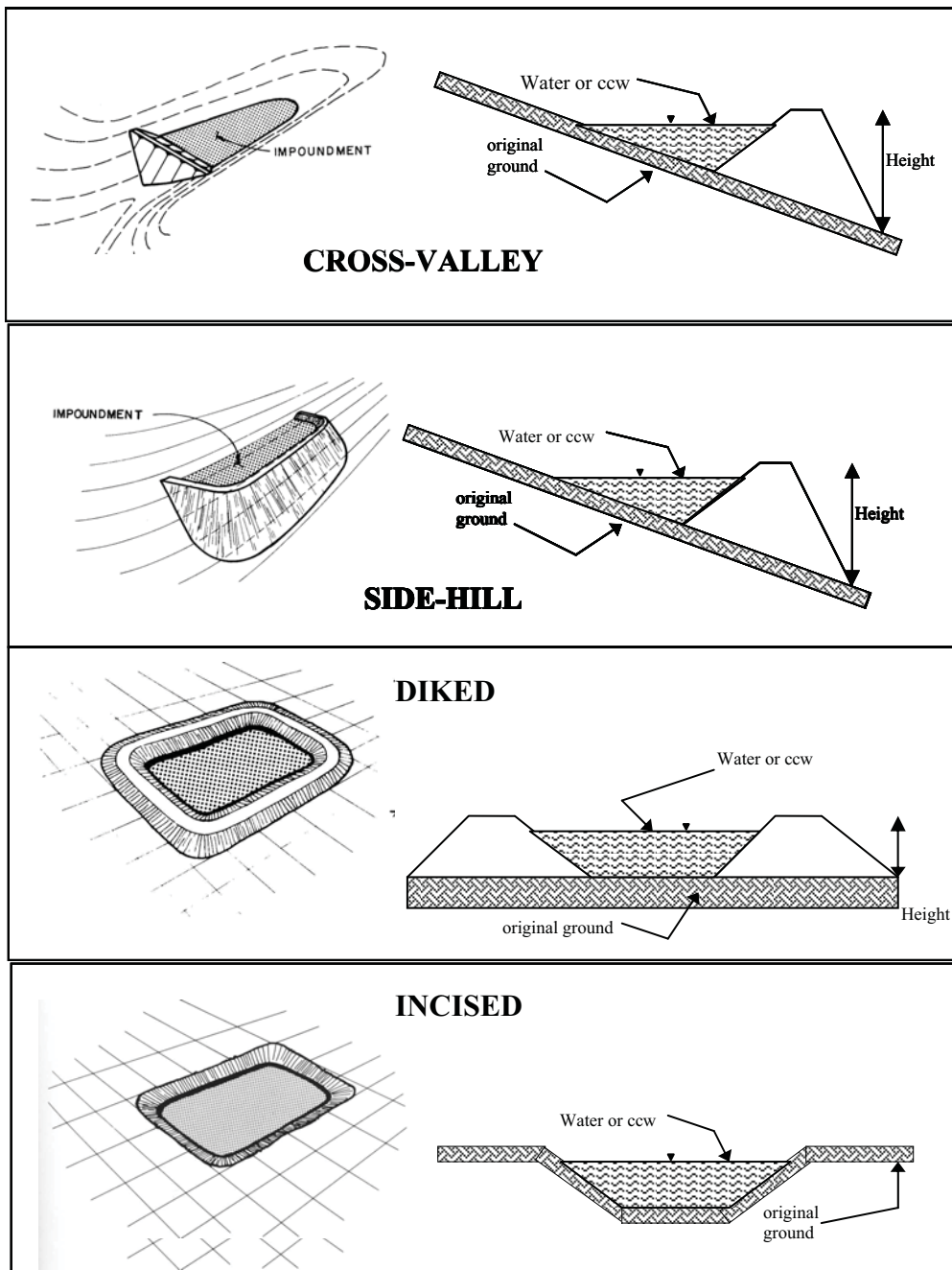
SIGNIFICANT HAZARD POTENTIAL: Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

HIGH HAZARD POTENTIAL: Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Failure or mis-operation would result in low economic loss and low environmental damage to adjacent waterways and downstream areas. Losses would be limited to Owner's property. No probable loss of human life is anticipated.

CONFIGURATION:



☐ Cross-Valley
☒ Side-Hill
☐ Diked
☐ Incised (form completion optional)
☐ Combination Incised/Diked
 Embankment Height 23 feet Embankment Material Earthen
 Pool Area 6.5 acres Liner No Liner
 Current Freeboard 8 feet Liner Permeability Not Applicable
 (Limited water standing
 at bottom of pond)

TYPE OF OUTLET (Mark all that apply)

☐ **Open Channel Spillway**

☐ Trapezoidal

☐ Triangular

☐ Rectangular

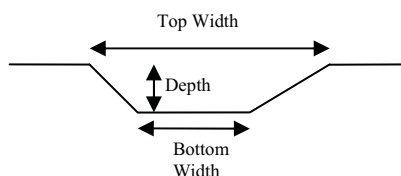
☐ Irregular

☐ depth

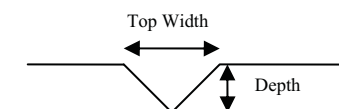
☐ bottom (or average) width

☐ top width

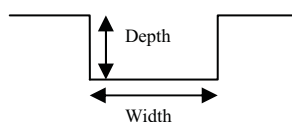
TRAPEZOIDAL



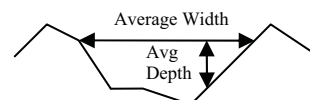
TRIANGULAR



RECTANGULAR



IRREGULAR



☒ **Outlet**

18" inside diameter (vertical rise pipe)

Material

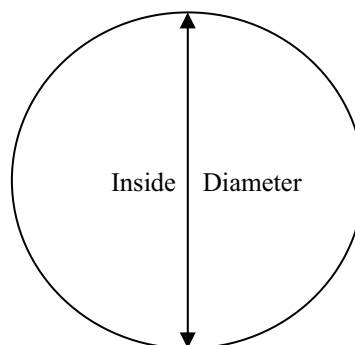
☒ corrugated metal

☐ welded steel

☐ concrete

☐ plastic (hdpe, pvc, etc.)

☐ other (specify) _____



Is water flowing through the outlet? YES _____ NO ☒

☐ **No Outlet**

☐ **Other Type of Outlet** (specify) _____

The Impoundment was Designed By USDA Soil Conservation Service
(Brunson & Roberts)

US EPA ARCHIVE DOCUMENT

[illegible]

US EPA ARCHIVE DOCUMENT

[illegible]

If so, which method (e.g., piezometers, gw pumping,...)? _____

If so Please Describe :

EPA Form XXXX-XXX, Jan 09

Appendix C

Photographs

Appendix C
Photographs GPS Locations

Site: Crisp County Power Commission - Plant Crisp
Datum: NAD83
Coordinate Units: Decimal Degrees

Photograph No.	Latitude	Longitude
1	31.845344	-83.943060
2	31.845307	-83.943079
3	31.845323	-83.943009
4	31.845336	-83.943154
5	31.845473	-83.943320
6	31.845455	-83.943362
7	31.845500	-83.944360
8	31.845502	-83.944403
9	31.845347	-83.944541
10	31.845355	-83.944585
11	31.845323	-83.944616
12	31.845333	-83.944675
13	31.845284	-83.944643
14	31.845490	-83.944547
15	31.845490	-83.944596
16	31.845493	-83.945288
17	31.845422	-83.945388
18	31.845276	-83.945386
19	31.845317	-83.945384
20	31.845360	-83.945353
21	31.845165	-83.945391
22	31.845100	-83.945389
23	31.845128	-83.945438
24	31.845024	-83.945340
25	31.844853	-83.945410
26	31.844859	-83.945310
27	31.844888	-83.945371
28	31.844819	-83.945373
29	31.844309	-83.945442
30	31.844405	-83.945446
31	31.844353	-83.945462
32	31.844227	-83.945420
33	31.844144	-83.945356
34	31.844199	-83.945288
35	31.844148	-83.945281
36	31.844098	-83.945248
37	31.844049	-83.945211
38	31.844001	-83.945224
39	31.843972	-83.945176
40	31.843988	-83.944666
41	31.843988	-83.944606
42	31.844049	-83.944611
43	31.844047	-83.944663
44	31.843926	-83.944613
45	31.843933	-83.944669
46	31.844037	-83.943746
47	31.844002	-83.943713
48	31.844090	-83.943643
49	31.844069	-83.943692

Appendix C
Photographs GPS Locations

Site: Crisp County Power Commission - Plant Crisp

Datum: NAD83

Coordinate Units: Decimal Degrees

Photograph No.	Latitude	Longitude
50	31.844124	-83.943675
51	31.844397	-83.943443
52	31.844563	-83.943288
53	31.844715	-83.943233
54	31.844759	-83.943196
55	31.844941	-83.943107
56	31.844674	-83.942673
57	31.845245	-83.942940
58	31.845225	-83.942883
59	31.845283	-83.943287
60	31.845299	-83.943383
61	31.845275	-83.943532
62	31.845328	-83.943501
63	31.845150	-83.943181
64	31.845293	-83.944223
65	31.845295	-83.944190
66	31.845320	-83.944409
67	31.845339	-83.945115
68	31.845314	-83.945154
69	31.845226	-83.945224
70	31.844948	-83.945210
71	31.844203	-83.945168
72	31.844155	-83.945113
73	31.844086	-83.944488
74	31.844177	-83.944440
75	31.844065	-83.944256

EPA Assessment Crisp County Power Plant Photos August 30, 2012



Photo 1: Ash Pond – Crest of north embankment, looking west.



Photo 2: Ash Pond – North embankment interior slope, looking west.



Photo 3: Ash Pond – North embankment interior slope, general view of pond surface area looking southwest.

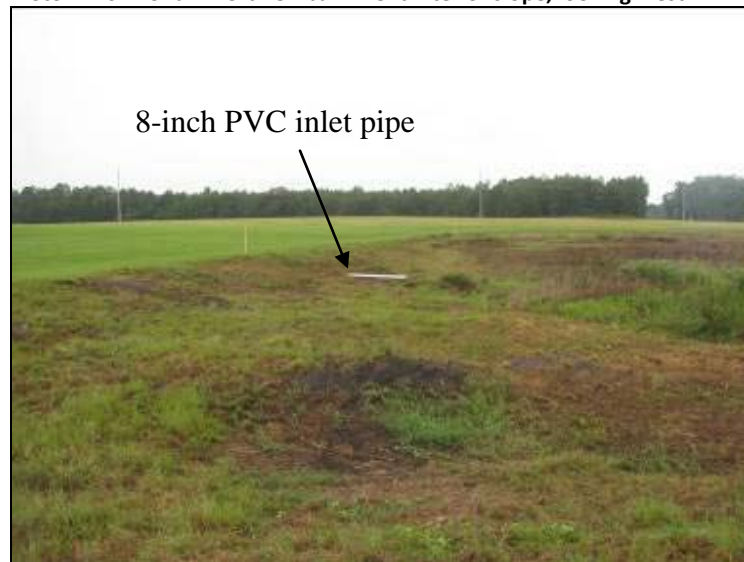


Photo 4: Ash Pond – Southeast embankment interior slope and pond surface area, looking south.

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Photo 5: Ash Pond – North embankment exterior slope, minor surficial erosion looking south.



Photo 6: Ash Pond – North embankment exterior slope, change in slope grade from approximately 2.8 H:1V to 2H:1V, looking west.



Photo 7: Ash Pond – North embankment exterior slope, surficial erosion rill running from crest to toe of slope looking south.



Photo 8: Ash Pond – North embankment exterior slope, erosion rill near crest, looking south.

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Photo 9: Ash Pond – North embankment interior slope, looking east.



Photo 10: Ash Pond – North embankment interior slope, looking west.



Photo 11: Ash Pond – North embankment interior slope, 18-inch outlet riser pipe, looking east.



Photo 12: Ash Pond – North embankment interior slope, boardwalk and 18-inch outlet riser pipe looking east.

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Photo 13: Ash Pond – General view of pond bottom surface, looking south.



Photo 14: Ash Pond – North embankment exterior slope, looking east.



Photo 15: Ash Pond – North embankment exterior slope, looking west.



Photo 16: Ash Pond – North embankment exterior slope near northwest corner, looking east.

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Photo 17: Ash Pond – West embankment exterior slope near northwest corner, looking west.



Photo 18: Ash Pond – West embankment exterior slope sloughing, looking South.

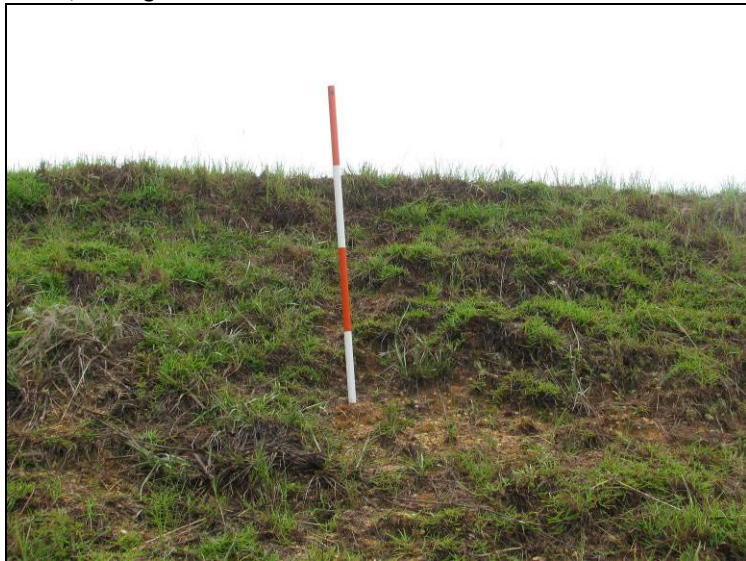


Photo 19: Ash Pond – West embankment exterior slope sloughing, looking east.



Photo 20: Ash Pond – West embankment exterior slope sloughing, looking southeast.

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Photo 21: Ash Pond – West embankment exterior slope, apparent 16-foot long semi-circular sloughing, looking southeast.



Photo 22: Ash Pond – West embankment exterior slope, apparent 16-foot long semi-circular sloughing, looking north.



Photo 23: Ash Pond – West embankment exterior slope, apparent 16-foot long semi-circular sloughing, looking east.

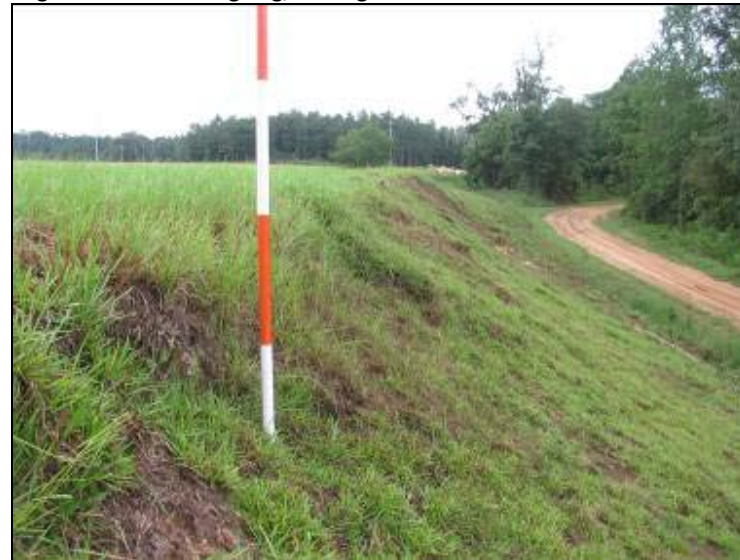


Photo 24: Ash Pond – West embankment exterior slope, scarp near crest of embankment, looking southeast.

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Photo 25: Ash Pond – West embankment exterior slope, sloughing near crest of embankment, looking east.



Photo 26: Ash Pond – West embankment exterior slope, sloughing near crest, looking west.



Photo 27: Ash Pond – West embankment exterior slope, looking north.



Photo 28: Ash Pond – West embankment exterior slope, looking south.
Note: steepness of slope (2H:1V).

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Photo 29: Ash Pond – West embankment exterior slope, swale cut at toe of slope, looking east.



Photo 30: Ash Pond – West embankment exterior slope, swale cut at toe of slope, looking east.



Photo 31: Ash Pond – West embankment exterior slope, toe of slope and road looking north.



Photo 32: Ash Pond – West embankment exterior slope near southwest corner, looking north.

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Photo 33: Ash Pond – West embankment exterior slope near southwest corner, looking north.



Photo 34: Ash Pond – Crest of west embankment looking north.



Photo 35: Ash Pond – General view of pond surface area looking northeast.



Photo 36: Ash Pond – General view of pond surface area looking northeast.

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Photo 37: Ash Pond – Crest of South embankment looking east.



Photo 38: Ash Pond – South embankment exterior slope, looking east.



Photo 39: Ash Pond – South embankment exterior slope, looking east.



Photo 40: Ash Pond – Crest of south embankment looking west.

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Photo 41: Ash Pond – Crest South Embankment looking east.



Photo 42: Ash Pond – South embankment interior slope, looking east.



Photo 43: Ash Pond – South embankment interior slope, looking west.



Photo 44: Ash Pond – South embankment exterior slope, looking east.

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Photo 45: Ash Pond – South embankment exterior slope, looking west.



Photo 46: Ash Pond –Crest of South embankment near southeast corner looking west.



Photo 47: Ash Pond – General view of floodplain area south of Ash Pond, looking southeast.



Photo 48: Ash Pond – Crest of southeast embankment near southeast corner, looking northeast.

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Photo 49: Ash Pond – General view of pond surface area near southeast corner, looking northwest.



Photo 51: Ash Pond – Southeast embankment interior slope, 7-inch I.D. Ductile iron pipe looking northwest.

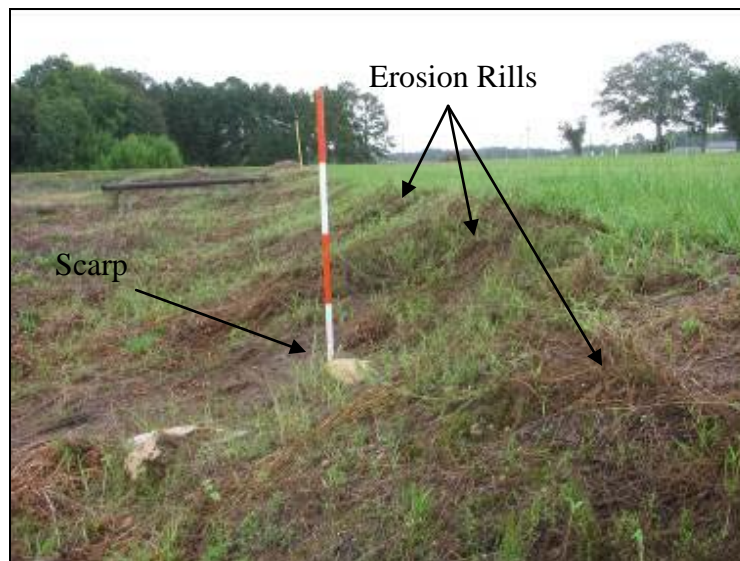


Photo 50: Ash Pond – Southeast embankment interior slope, looking northeast. Note: erosion rills and surficial scarps.



Photo 52: Ash Pond – Permit sign on southeast embankment, looking west.

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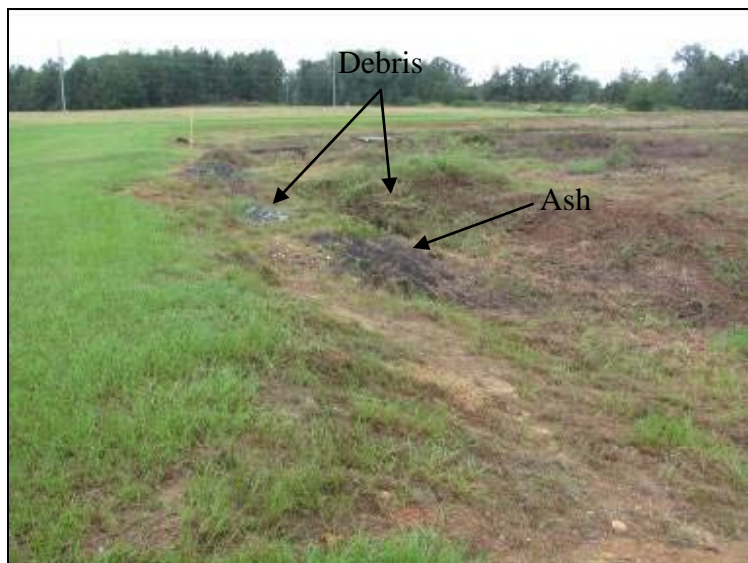


Photo 53: Ash Pond – Crest and interior slope southeast embankment, looking southwest. Note: Ash and debris at pond surface.



Photo 55: Ash Pond – Southeast embankment interior slope, 8-inch PVC inlet pipe, looking northwest.



Photo 54: Ash Pond – General view of pond surface, looking west.



Photo 56: Ash Pond – General view of Ash pond, looking west.

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Photo 57: Ash Pond –North embankment interior slope near northeast corner, looking west.



Photo 58: Ash Pond – Crest of southeast embankment near northeast corner, looking southwest.

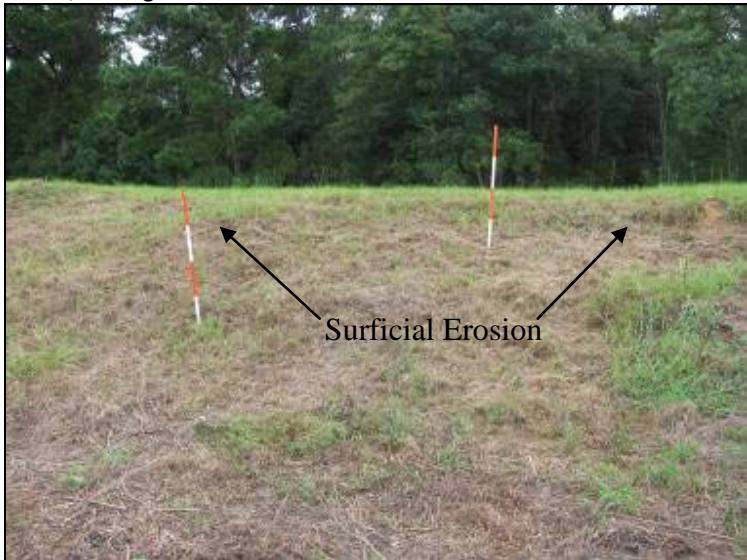


Photo 59: Ash Pond – North embankment interior slope, surficial erosion (30-feet long) looking northwest.



Photo 60: Ash Pond – North embankment interior slope, looking west.

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Photo 61: Ash Pond – North embankment interior slope surficial erosion, looking north.



Photo 62: Ash Pond – North embankment interior slope surficial erosion, looking west.



Photo 63: Ash Pond – 8-inch PVC inlet pipe on southeast embankment, looking south. Note: water flowing.



Photo 64: Ash Pond – North embankment interior slope, boardwalk and outlet 18-inch CMP riser pipe looking west.

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Photo 65: Ash Pond – North embankment interior slope, looking north.
Note: boulder (12"-24") and steepness of slope (2H:1V).



Photo 66: Ash Pond – North Embankment interior slope, erosion rills near outlet structure looking north.



Photo 67: Ash Pond – North embankment interior slope, looking east.



Photo 68: Ash Pond – West embankment interior slope, looking south.
Note: ponded water near northwest corner of pond.

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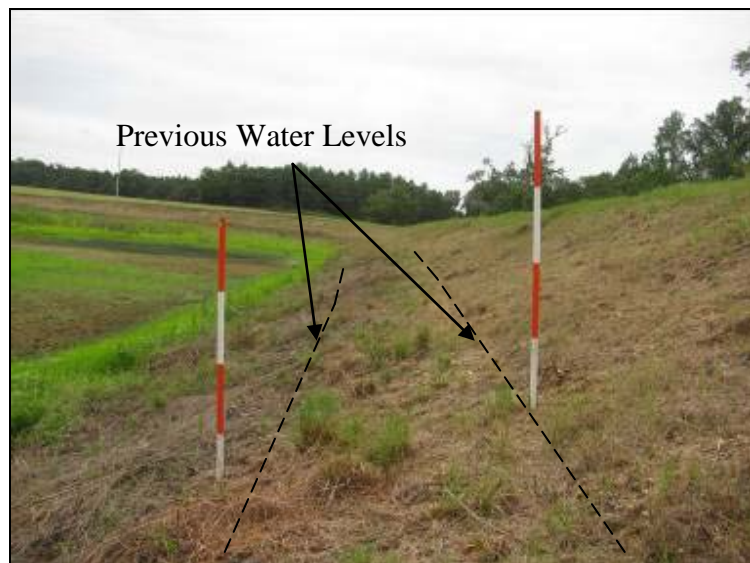


Photo 69: Ash Pond – West embankment interior slope, looking south. Note apparent previous water level marks.

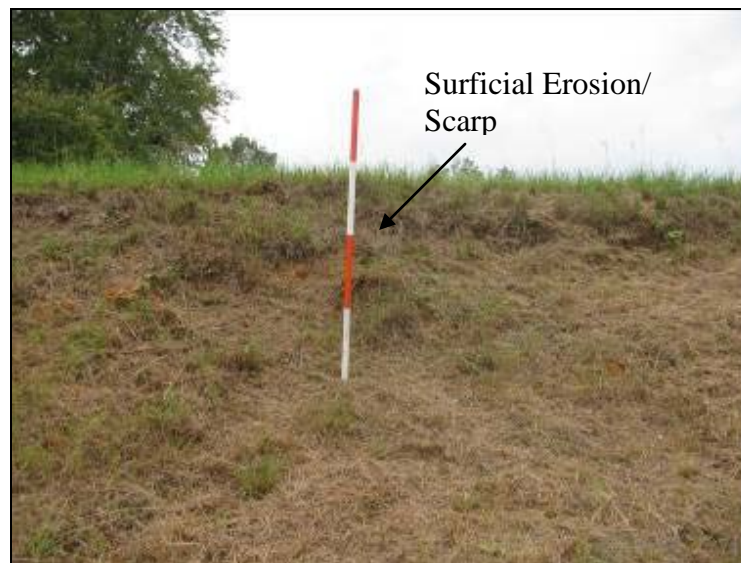


Photo 70: Ash Pond – West embankment interior slope surficial erosion/scarp, looking west.



Photo 71: Ash Pond – West embankment interior slope, looking north.



Photo 72: Ash Pond – South embankment interior slope, looking east.

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Photo 73: Ash Pond – South embankment interior slope, looking south. Note protruding rock at slope face.



Photo 74: Ash Pond – Incised channel in the Ash deposited at bottom of pond, looking east.



Photo 75: Ash Pond – South embankment interior slope, surficial erosion looking southeast.

